TROY TECHNICAL

ADHESIVES & SEALANTS
WEEKLY REPORT

November 14 - November 20, 2026 | Issue 2026-W46

Bond-line performance, cure process, durability and cross-industry qualification

12	10
ANALYZED ARTICLES	PRIORITY THEMES

Issued 2026-11-20 | English edition | fixed approved cover artwork



Adhesives & Sealants: the boundary moved from isolated claims to qualification evidence

12 English articles were reviewed independently from the Japanese edition. Ten themes are retained for management decisions.

SIGNAL 01 | CHEMISTRY

Euglena-derived Binder: PVDF Alternative for Li-ion Batteries

The National Institute of Advanced Industrial Science and Technology (AIST) has developed a biomass-based cathode binder derived from Euglena.

SIGNAL 02 | FORMULATION

2.5D Packaging BGA Solder Joints: Random Vibration Optimization

Research into 2.5D packaging has identified an optimal parameter combination-upper BGA height of 0.24 mm, lower BGA height of 0.38 mm, and interposer thickness of 0.1 mm-to minimize solder joint stress.

SIGNAL 03 | APPLICATION & CURE

UV-Ozone Fabric Treatment: Boosting 3D Polymer Adhesion by 239%

UV-C light and ozone surface modification of polyethylene terephthalate (PET) fabric increases the peel strength of 3D-printed thermoplastic polyurethane (TPU) by up to 239 percent.

SIGNAL 04 | QUALIFIED PRODUCT

Composite Epoxy Coating: Delaying LIB Thermal Runaway by 465s

Researchers have developed a composite flame-retardant epoxy coating that delays the onset of lithium-ion battery thermal runaway by 465 s and reduces adjacent cell peak temperatures by 272 °C.

DECISION

Focus this week's management attention on bond-line performance, cure process, durability and cross-industry qualification. Move only when the linked evidence can be reproduced under your own operating conditions.

THREE MANAGEMENT MOVES

1. Buyers: evaluate the complete joint or sealed system under process and lifetime conditions.
2. Suppliers: provide substrate preparation, cure window, rework, aging and failure-analysis evidence.
3. Executives: track adhesion aging, cure variability, outgassing, regulation, repair and scale.

EVIDENCE DISCIPLINE

FACT states what the collected English source reports. BUSINESS READ and ACTION are editorial interpretations. UNKNOWN lists information that the source file does not establish. A linked article is not treated as independent confirmation of every claim.

Numbers and evidence anchors that require conditions

97%
A07

SOURCE-BOUND CONDITION
The material achieves a capacity retention rate of over 97% after 100 cycles, matching the performance of conventional fluorine-based polymers.

0.24 mm
A03

SOURCE-BOUND CONDITION
Research into 2.5D packaging has identified an optimal parameter combination-upper BGA height of 0.24 mm, lower BGA height of 0.38 mm, and interposer thickness of 0.1 mm-to minimize solder joint stress.

76.4%
A11

SOURCE-BOUND CONDITION
The material achieves UL-94 V-0 classification and cuts total smoke production by up to 76.4%, significantly enhancing safety for electromobility and energy storage.

99.8%
A09

SOURCE-BOUND CONDITION
An international research team has developed an induction heating-assisted delamination method for glass-to-glass PV modules that recovers 99.8% of the original mass.

71%
A06

SOURCE-BOUND CONDITION
The materials achieve a bio-carbon content of 71% and demonstrate rapid degradation under alkaline conditions, offering a sustainable alternative to petroleum-based polymers.

HOW TO USE THESE NUMBERS
Each value is shown with the condition stated in the collected English article. Do not compare values across different test methods, device sizes, operating temperatures or commercial stages without normalizing those conditions.

Where the value chain moved

Each stage combines one leading theme and one supporting theme. The report treats handoffs as evidence transfers, not decorative arrows.

1

Chemistry

P01/P06

The National Institute of Advanced Industrial Science and Technolog y (AIST) has developed a biomass-based cathode binder.

2

Formulation

P02/P07

Research into 2.5D packaging has identified an optimal parameter combinatio n-upper BGA height of 0.24 mm, lower BGA height of.

3

Application & cure

P03/P08

UV-C light and ozone surface modification of polyethylene terephthalate (PET) fabric increases the peel strength of.

4

Qualified product

P04/P09

Researchers have developed a composite flame-retar dant epoxy coating that delays the onset of lithium-ion battery thermal.

5

Repair & circularity

P05/P10

An international research team has developed an induction heating-assi sted delamination method for glass-to-gl ass PV modules.

EVIDENCE REQUIRED AT EACH HANDOFF

Chemistry to Formulation	Transfer test conditions, acceptance criteria, failure data, owner and decision date. Recheck adhesion aging, cure variability, outgassing, regulation, repair and scale.
Formulation to Application & cure	Transfer test conditions, acceptance criteria, failure data, owner and decision date. Recheck adhesion aging, cure variability, outgassing, regulation, repair and scale.
Application & cure to Qualified product	Transfer test conditions, acceptance criteria, failure data, owner and decision date. Recheck adhesion aging, cure variability, outgassing, regulation, repair and scale.
Qualified product to Repair & circularity	Transfer test conditions, acceptance criteria, failure data, owner and decision date. Recheck adhesion aging, cure variability, outgassing, regulation, repair and scale.

COMMON CONTROL POINT

No theme moves to a commercial commitment until a named owner has reproduced the relevant evidence and documented adhesion aging, cure variability, outgassing, regulation, repair and scale.

Priority map: maturity and next decision locus



P01	Euglena-derived Binder: PVDF Alternative for Li-ion Batteries Business / rules | cue: capacity
P02	2.5D Packaging BGA Solder Joints: Random Vibration Optimization Tech / process | cue: no system/business cue
P03	UV-Ozone Fabric Treatment: Boosting 3D Polymer Adhesion by 239% Tech / process | cue: no system/business cue
P04	Composite Epoxy Coating: Delaying LIB Thermal Runaway by 465s Tech / process | cue: no system/business cue
P05	PV Module Recycling: Induction Heating for 99.8% Mass Recovery Tech / process | cue: no system/business cue
P06	Polymer Fiber Forest: Cornell's Thermal Interface Material Specs System / adoption | cue: commercial
P07	Cashew Nut Shell Polyurethane: Bio-based Adhesive and Foam Specs Tech / process | cue: no system/business cue
P08	Black Phosphorus Nanosheets: Flame-Retardant Epoxy Resin Specs Tech / process | cue: no system/business cue
P09	Lake-Thomas Model Adhesives: Backbone Length for Tough Interfaces System / adoption | cue: system
P10	Dai-ichi Kogyo Seiyaku: High-Strength Room-Temperature Urethane Resin Specs Tech / process | cue: no system/business cue

REPRODUCIBLE POSITIONING RULE

Horizontal position uses five discrete stages: Research, Prototype, Joint evaluation, Product adoption and Scale. The vertical bands classify the next decision locus: Tech / process, System / adoption, or Business / rules (including supply systems). Article-title cues take precedence; the overview is used only when the title is silent. These are categories, not impact ranks. Bubble diameter reflects the editorial score.

FACT is source-bound. BUSINESS READ, ACTION and UNKNOWN are explicit editorial layers.

P01 Euglena-derived Binder: PVDF Alternative for Li-ion Batteries

A07 | Chemistry | Product adoption

2026-11-18

FACT

The National Institute of Advanced Industrial Science and Technology (AIST) has developed a biomass-based cathode binder derived from Euglena. The material achieves a capacity retention rate of over 97% after 100 cycles, matching the performance of conventional fluorine-based polymers.

WHY IT MATTERS

The decision relevance is bond-line performance, cure process, durability and cross-industry qualification. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, provide substrate preparation, cure window, rework, aging and failure-analysis evidence.

ACTION

Within 30 days, evaluate the complete joint or sealed system under process and lifetime conditions; record the evidence and owner against P01.

UNKNOWN

Still unproven or incompletely stated: adhesion aging, cure variability, outgassing, regulation, repair and scale.

EDITORIAL SCORE 20/25 | MATURITY 4/5 | DECISION LOCUS: BUSINESS / RULES

P02 2.5D Packaging BGA Solder Joints: Random Vibration Optimization

A03 | Formulation | Research

2026-11-16

FACT

Research into 2.5D packaging has identified an optimal parameter combination-upper BGA height of 0.24 mm, lower BGA height of 0.38 mm, and interposer thickness of 0.1 mm-to minimize solder joint stress. By utilizing finite element modeling and the Taguchi method, the study determines how specific geometric factors influence vibration reliability. These findings provide a framework for reducing cumulative fatigue damage in high-performance packaging structures.

WHY IT MATTERS

The decision relevance is bond-line performance, cure process, durability and cross-industry qualification. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, provide substrate preparation, cure window, rework, aging and failure-analysis evidence.

ACTION

Within 30 days, evaluate the complete joint or sealed system under process and lifetime conditions; record the evidence and owner against P02.

UNKNOWN

Still unproven or incompletely stated: adhesion aging, cure variability, outgassing, regulation, repair and scale.

EDITORIAL SCORE 20/25 | MATURITY 1/5 | DECISION LOCUS: TECH / PROCESS

FACT is source-bound. BUSINESS READ, ACTION and UNKNOWN are explicit editorial layers.

P03 UV-Ozone Fabric Treatment: Boosting 3D Polymer Adhesion by 239%

A01 | Application & cure | Product adoption

2026-11-20

FACT

UV-C light and ozone surface modification of polyethylene terephthalate (PET) fabric increases the peel strength of 3D-printed thermoplastic polyurethane (TPU) by up to 239 percent. This dry treatment enhances interfacial bonding without requiring chemical adhesives or significantly degrading the substrate's tensile strength. The method addresses critical delamination challenges in the production of functional wearable technology and advanced apparel.

WHY IT MATTERS

The decision relevance is bond-line performance, cure process, durability and cross-industry qualification. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, provide substrate preparation, cure window, rework, aging and failure-analysis evidence.

ACTION

Within 30 days, evaluate the complete joint or sealed system under process and lifetime conditions; record the evidence and owner against P03.

UNKNOWN

Still unproven or incompletely stated: adhesion aging, cure variability, outgassing, regulation, repair and scale.

EDITORIAL SCORE 20/25 | MATURITY 4/5 | DECISION LOCUS: TECH / PROCESS

P04 Composite Epoxy Coating: Delaying LIB Thermal Runaway by 465s

A11 | Qualified product | Product adoption

2026-11-19

FACT

Researchers have developed a composite flame-retardant epoxy coating that delays the onset of lithium-ion battery thermal runaway by 465 s and reduces adjacent cell peak temperatures by 272 °C. The material achieves UL-94 V-0 classification and cuts total smoke production by up to 76.4%, significantly enhancing safety for electromobility and energy storage.

WHY IT MATTERS

The decision relevance is bond-line performance, cure process, durability and cross-industry qualification. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, provide substrate preparation, cure window, rework, aging and failure-analysis evidence.

ACTION

Within 30 days, evaluate the complete joint or sealed system under process and lifetime conditions; record the evidence and owner against P04.

UNKNOWN

Still unproven or incompletely stated: adhesion aging, cure variability, outgassing, regulation, repair and scale.

EDITORIAL SCORE 20/25 | MATURITY 4/5 | DECISION LOCUS: TECH / PROCESS

FACT is source-bound. BUSINESS READ, ACTION and UNKNOWN are explicit editorial layers.

P05 PV Module Recycling: Induction Heating for 99.8% Mass Recovery

A09 | Repair & circularity | Pilot

2026-11-16

FACT

An international research team has developed an induction heating-assisted delamination method for glass-to-glass PV modules that recovers 99.8% of the original mass. The process enables rapid separation of silicon cells from encapsulants in as little as 5.4 seconds, significantly improving the recyclability of end-of-life modules.

WHY IT MATTERS

The decision relevance is bond-line performance, cure process, durability and cross-industry qualification. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, provide substrate preparation, cure window, rework, aging and failure-analysis evidence.

ACTION

Within 30 days, evaluate the complete joint or sealed system under process and lifetime conditions; record the evidence and owner against P05.

UNKNOWN

Still unproven or incompletely stated: adhesion aging, cure variability, outgassing, regulation, repair and scale.

EDITORIAL SCORE 20/25 | MATURITY 2/5 | DECISION LOCUS: TECH / PROCESS

P06 Polymer Fiber Forest: Cornell's Thermal Interface Material Specs

A08 | Chemistry | Pilot

2026-11-18

FACT

Researchers at Cornell have developed a "polymer fiber forest" architecture that enhances heat dissipation in electronics without conducting electricity. The epoxy-based version reduced surface temperatures by 17 degrees Celsius compared to commercial ceramic-filled silicone pads.

WHY IT MATTERS

The decision relevance is bond-line performance, cure process, durability and cross-industry qualification. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, provide substrate preparation, cure window, rework, aging and failure-analysis evidence.

ACTION

Within 30 days, evaluate the complete joint or sealed system under process and lifetime conditions; record the evidence and owner against P06.

UNKNOWN

Still unproven or incompletely stated: adhesion aging, cure variability, outgassing, regulation, repair and scale.

EDITORIAL SCORE 20/25 | MATURITY 2/5 | DECISION LOCUS: SYSTEM / ADOPTION

FACT is source-bound. BUSINESS READ, ACTION and UNKNOWN are explicit editorial layers.

P07 Cashew Nut Shell Polyurethane: Bio-based Adhesive and Foam Specs

A06 | Formulation | Pilot

2026-11-20

FACT

A research team from Inha University developed a biodegradable and reprocessable polyurethane adhesive and foam using cardanol extracted from cashew nut shells. The materials achieve a bio-carbon content of 71% and demonstrate rapid degradation under alkaline conditions, offering a sustainable alternative to petroleum-based polymers.

WHY IT MATTERS

The decision relevance is bond-line performance, cure process, durability and cross-industry qualification. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, provide substrate preparation, cure window, rework, aging and failure-analysis evidence.

ACTION

Within 30 days, evaluate the complete joint or sealed system under process and lifetime conditions; record the evidence and owner against P07.

UNKNOWN

Still unproven or incompletely stated: adhesion aging, cure variability, outgassing, regulation, repair and scale.

EDITORIAL SCORE 19/25 | MATURITY 2/5 | DECISION LOCUS: TECH / PROCESS

P08 Black Phosphorus Nanosheets: Flame-Retardant Epoxy Resin Specs

A04 | Application & cure | Pilot

2026-11-16

FACT

Researchers have developed a multifunctional nano-curing agent combining aminopropyl-imidazole with black phosphorus nanosheets to enhance the fire safety and mechanical properties of epoxy resin. The additive suppresses combustible volatiles and promotes a graphitized char layer, significantly reducing the peak heat release rate.

WHY IT MATTERS

The decision relevance is bond-line performance, cure process, durability and cross-industry qualification. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, provide substrate preparation, cure window, rework, aging and failure-analysis evidence.

ACTION

Within 30 days, evaluate the complete joint or sealed system under process and lifetime conditions; record the evidence and owner against P08.

UNKNOWN

Still unproven or incompletely stated: adhesion aging, cure variability, outgassing, regulation, repair and scale.

EDITORIAL SCORE 19/25 | MATURITY 2/5 | DECISION LOCUS: TECH / PROCESS

FACT is source-bound. BUSINESS READ, ACTION and UNKNOWN are explicit editorial layers.

P09 Lake-Thomas Model Adhesives: Backbone Length for Tough Interfaces

A02 | Qualified product | Pilot

2026-11-17

FACT

Researchers have developed a molecular-scale bonding strategy that achieves an interfacial fracture energy of approximately 500 J m-2 for polyimide-polyimide bonding. By controlling the load-bearing backbone length of covalently interlinked molecular bridges, the system overcomes the toughening limitations of molecularly thin interfaces. This approach provides a method for creating mechanically robust heterogeneous integration.

WHY IT MATTERS

The decision relevance is bond-line performance, cure process, durability and cross-industry qualification. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, provide substrate preparation, cure window, rework, aging and failure-analysis evidence.

ACTION

Within 30 days, evaluate the complete joint or sealed system under process and lifetime conditions; record the evidence and owner against P09.

UNKNOWN

Still unproven or incompletely stated: adhesion aging, cure variability, outgassing, regulation, repair and scale.

EDITORIAL SCORE 19/25 | MATURITY 2/5 | DECISION LOCUS: SYSTEM / ADOPTION

P10 Dai-ichi Kogyo Seiyaku: High-Strength Room-Temperature Urethane Resin Specs

A05 | Repair & circularity | Product adoption

2026-11-20

FACT

Dai-ichi Kogyo Seiyaku has developed a two-component, room-temperature curing high-strength urethane resin that significantly improves adhesion to metals like aluminum. The material achieves 3 to 11 times the adhesion performance of conventional products while eliminating the need for heat curing, reducing energy consumption in manufacturing.

WHY IT MATTERS

The decision relevance is bond-line performance, cure process, durability and cross-industry qualification. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, provide substrate preparation, cure window, rework, aging and failure-analysis evidence.

ACTION

Within 30 days, evaluate the complete joint or sealed system under process and lifetime conditions; record the evidence and owner against P10.

UNKNOWN

Still unproven or incompletely stated: adhesion aging, cure variability, outgassing, regulation, repair and scale.

EDITORIAL SCORE 19/25 | MATURITY 4/5 | DECISION LOCUS: TECH / PROCESS

Playbook and 0-5 year roadmap

STAKEHOLDER	NOW | 0-30 DAYS	NEXT | 1-12 MONTHS	LATER | 1-5 YEARS
Operating companies	evaluate the complete joint or sealed system under process and lifetime conditions	Run production-like qualification with explicit acceptance and stop criteria.	Build a portfolio and architecture that can absorb technology and supplier changes.
Materials, equipment and technology suppliers	provide substrate preparation, cure window, rework, aging and failure-analysis evidence	Create shared reliability, process-window and failure-analysis data with customers.	Standardize interfaces, traceability, lifecycle support and recovery services.
Trading, investment and legal teams	Map adhesion aging, cure variability, outgassing, regulation, repair and scale.	Contract for capacity, quality, change notice, liability, alternatives and exit.	Diversify regional, technical and customer concentration risk.

ROADMAP

NOW | 0-30 DAYS
Evidence ledger
Owner: Strategy + quality
Deliverable: claim, source, condition, owner

NOW | 0-30 DAYS
Risk screen
Owner: Procurement + legal
Deliverable: unknowns, alternatives, stop

NEXT | 1-12 MONTHS
Joint qualification
Owner: R&D + supplier
Deliverable: process window and failure data

NEXT | 1-12 MONTHS
Commercial gate
Owner: Business + finance
Deliverable: unit economics and capacity

LATER | 1-5 YEARS
Platform strategy
Owner: Executive team
Deliverable: portfolio and interface roadmap

LATER | 1-5 YEARS
Service layer
Owner: Operations + channel
Deliverable: monitoring, maintenance and recovery

GO / NO-GO GATES

GATE	OWNER	REQUIRED EVIDENCE	NO-GO CONDITION
G1 Evidence	**Quality**	Source, test conditions and reproducibility	No traceable evidence
G2 Integration	**R&D**	Interface, process window and failure analysis	Cannot meet system conditions
G3 Commercial	**Business**	Capacity, total cost, contract and alternatives	Economics or supply cannot be supported
G4 Lifecycle	**Operations**	Monitoring, maintenance, change notice and exit	No accountable operating plan

ANALYZED ARTICLES | ITEMS 01-12

Every title and URL is displayed in full. URLs wrap without shortening and remain clickable. A verified-reference label means the translated HTML did not retain its original source URL.

ID	FULL ARTICLE TITLE	FULL SOURCE / VERIFIED REFERENCE URL - CLICKABLE
A01	UV-Ozone Fabric Treatment: Boosting 3D Polymer Adhesion by 239%	https://bioengineer.org/ultraviolet-ozone-fabric-treatment-boosts-3d-printed-polymer-adhesion-by-up-to-239-percent/
A02	Lake-Thomas Model Adhesives: Backbone Length for Tough Interfaces	https://doi.org/10.21203/rs.3.rs-11438059/v1
A03	2.5D Packaging BGA Solder Joints: Random Vibration Optimization	https://doi.org/10.21203/rs.3.rs-11033973/v1
A04	Black Phosphorus Nanosheets: Flame-Retardant Epoxy Resin Specs	https://bioengineer.org/functionalized-black-phosphorus-nanosheets-enhance-fire-safety-in-epoxy-resin/
A05	Dai-ichi Kogyo Seiyaku: High-Strength Room-Temperature Urethane Resin Specs	https://www.jiji.com/jc/article?k=000000229.000073630&g=prt
A06	Cashew Nut Shell Polyurethane: Bio-based Adhesive and Foam Specs	https://www.sanupin-news.kr/news/articleView.html?idxno=16157
A07	Euglena-derived Binder: PVDF Alternative for Li-ion Batteries	https://eetimes.itmedia.co.jp/ee/articles/2611/18/news037.html
A08	Polymer Fiber Forest: Cornell's Thermal Interface Material Specs	https://news.cornell.edu/stories/2026/11/microscopic-polymer-fiber-forest-helps-keep-electronics-cool
A09	PV Module Recycling: Induction Heating for 99.8% Mass Recovery	https://www.pv-magazine-australia.com/2026/11/16/new-glass-to-glass-pv-module-design-enables-rapid-delamination/
A10	Cu/In-Ag/Cu Bonding: Microwave Heating and Nano-Silver Specs	https://bioengineer.org/microwave-heating-and-nano-silver-boost-high-temperature-semiconductor-power-device-bonding/
A11	Composite Epoxy Coating: Delaying LIB Thermal Runaway by 465s	https://www.european-coatings.com/news/coatings-technologies/fire-safe-coating-delays-lithium-ion-battery-thermal-runaway/
A12	ECHA PFAS and Chromium(VI) Restrictions: 2026 Regulatory Timeline	https://www.european-coatings.com/news/legislation/echa-backs-eu-wide-restrictions-on-pfas-and-chromium-vi/

Adhesives_Sealants — Selected Articles

Date: 2026-11-21

Articles: 12

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#10 Cu/In-Ag/Cu Bonding: Microwave Heating and Nano-Silver Specs

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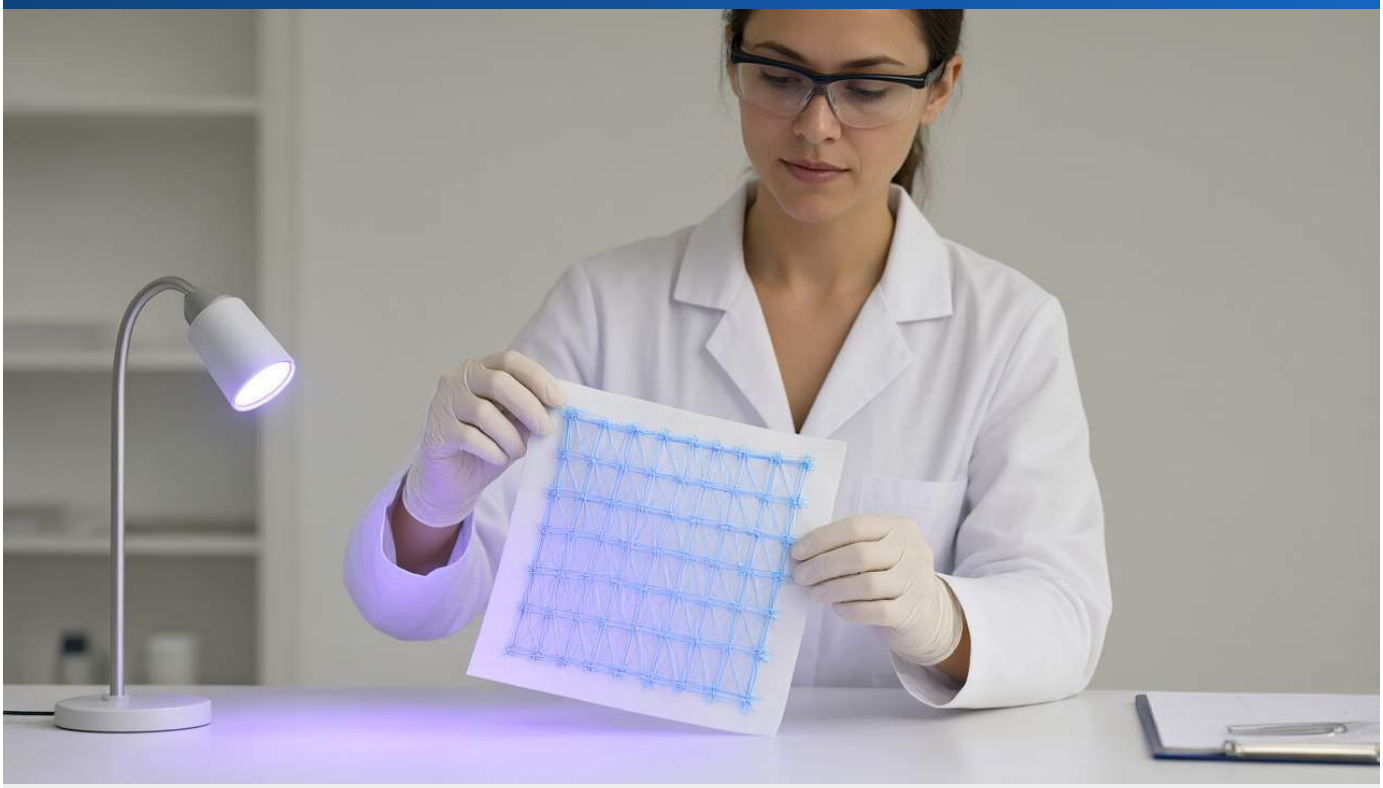
#12 ECHA PFAS and Chromium(VI) Restrictions: 2026 Regulatory Timeline

#01 UV-Ozone Fabric Treatment: Boosting 3D Polymer Adhesion by 239%

Published November 20, 2026 BIOENGINEER.ORG



OVERVIEW

UV-C light and ozone surface modification of polyethylene terephthalate (PET) fabric increases the peel strength of 3D-printed thermoplastic polyurethane (TPU) by up to 239 percent. This dry treatment enhances interfacial bonding without requiring chemical adhesives or significantly degrading the substrate's tensile strength. The method addresses critical delamination challenges in the production of functional wearable technology and advanced apparel.

IN DEPTH

Key Findings

Experimental investigation published in *Fashion and Textiles* demonstrates that treating polyethylene terephthalate (PET) fabric with ultraviolet-C (UV-C) light and ozone significantly improves the adhesion of directly deposited thermoplastic polyurethane (TPU). The process increased peel strength by up to 239 percent compared to untreated control fabrics. Notably, this enhancement occurred without the use of intermediate adhesive chemical layers, and the overall tensile strength of the substrate fabric decreased by less than 3 percent.

Technical Details

The researchers utilized a dry surface modification method using a UV irradiator emitting 254 nanometers radiation at an intensity of 20 milliwatts per square centimeter. PET fabric swatches were irradiated for 30 or 60 minutes at distances of either 2 centimeters or 5 centimeters. This resulted in energy doses ranging from 1,440 millijoules per square centimeter to 18,000 millijoules per square centimeter.

Following treatment, TPU filaments were deposited via fused deposition modeling (FDM) using the following parameters:

- Nozzle temperature: 240 degrees Celsius
- Build platform temperature: 60 degrees Celsius
- Printing velocity: 30 millimeters per second
- Internal infill density: 20 percent
- Minimum printing gap: 300 (calibrated against a fabric thickness of 0.31 millimeters)

Focused ion beam scanning electron microscopy revealed that while untreated PET fibers were smooth, treated fibers exhibited localized micro-etching and blister-like features caused by photo-oxidative reactions.

Background & Context

3D-printed composite fabrics are valued in wearable technology for combining additive manufacturing precision with textile flexibility. However, PET is chemically inert and hydrophobic with low surface energy, which hinders molecular interaction with molten polymers. While previous research focused on mechanical adjustments—such as reducing nozzle-to-bed distance or increasing temperatures to lower melt viscosity—this study targets the physicochemical properties of the substrate itself.

Significance & Outlook

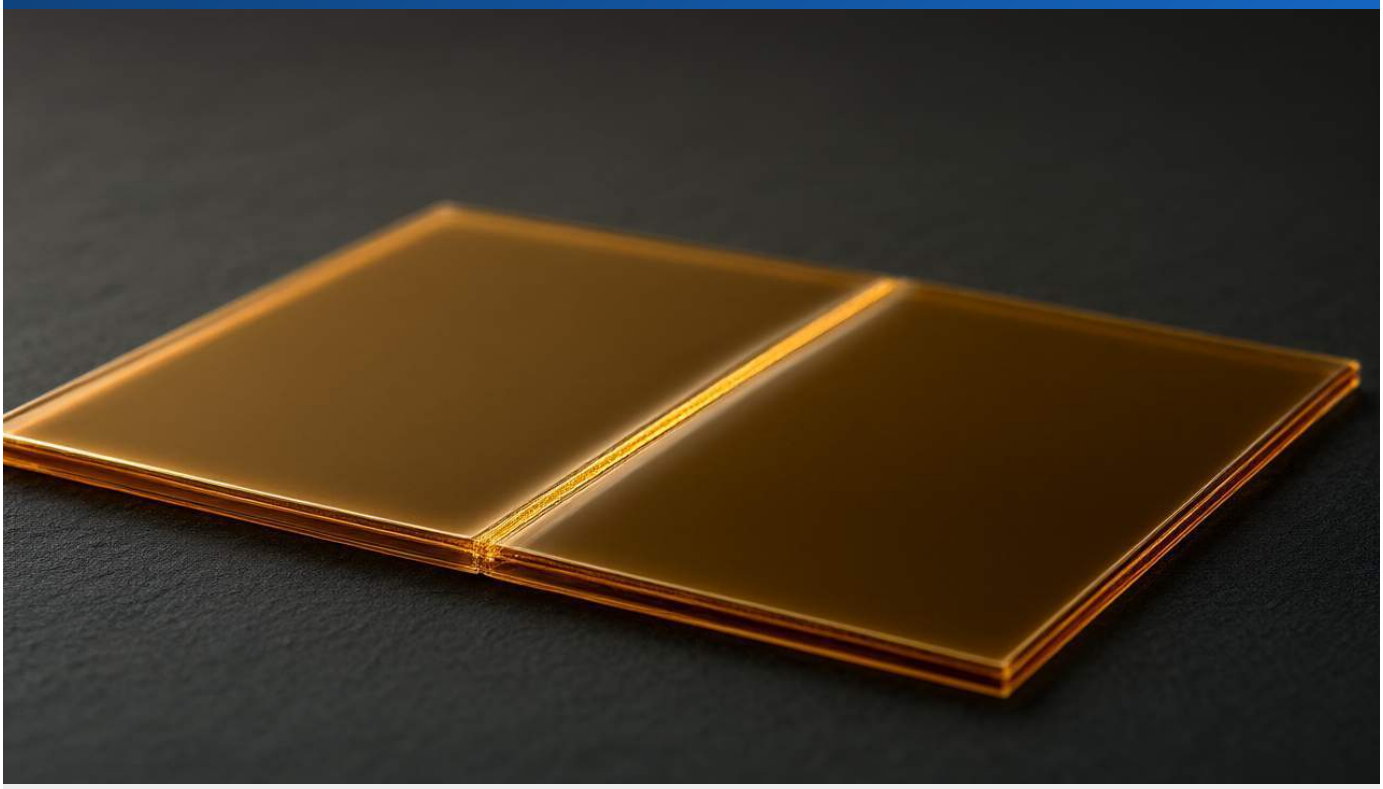
By providing a targeted physical and chemical approach to surface modification, this method mitigates premature delamination during bending and stretching. This increases the functional durability of polymer structures printed directly onto woven textiles, supporting the long-term reliability of integrated mechanical components and protective frameworks in advanced apparel.

Source: https://bioengineer.org/ultraviolet-ozone-fabric-treatment-boosts-3d-printed-polymer-adhesion-by-up-to-239-percent/

Collected: November 21, 2026 | Automated Research System (AI)

#02 Lake–Thomas Model Adhesives: Backbone Length for Tough Interfaces

Published November 17, 2026　Research Square（プレプリント）



OVERVIEW

Researchers have developed a molecular-scale bonding strategy that achieves an interfacial fracture energy of approximately 500 J m^{-2} for polyimide–polyimide bonding. By controlling the load-bearing backbone length of covalently interlinked molecular bridges, the system overcomes the toughening limitations of molecularly thin interfaces. This approach provides a method for creating mechanically robust heterogeneous integration.

IN DEPTH

Key Findings

The study demonstrates that the interfacial fracture resistance of molecularly thin interfaces can be systematically controlled by adjusting the length of the load-bearing backbone of covalently interlinked molecular bridges. In a polyimide–polyimide bonding application, this strategy achieved an interfacial fracture energy of approximately 500 J m^{-2} within a sub-5-nm interphase.

Technical Details

The bonding strategy utilizes the Lake–Thomas framework to guide the design of molecular bridges connecting opposing surfaces. The primary technical mechanisms include:

- **Backbone Length Control:** The fracture work of individual load-bearing connections is determined by the length of the bridge backbone, which directly controls the overall interfacial fracture resistance.
- **Chain Organization:** Surface analysis and molecular-dynamics simulations indicate that the organization of surface-tethered chains modulates the length-dependent toughening by influencing bridge density.
- **Versatility:** The method is effective for strengthening dissimilar interfaces and maintains reliability when exposed to environmental conditions.

Background & Context

Traditionally, high interfacial fracture resistance has relied on adhesive layers with finite thickness, as these layers dissipate energy through deformation. Molecularly thin interfaces have historically struggled to provide sufficient volume for this type of toughening, limiting their mechanical robustness in high-stress applications.

Significance & Outlook

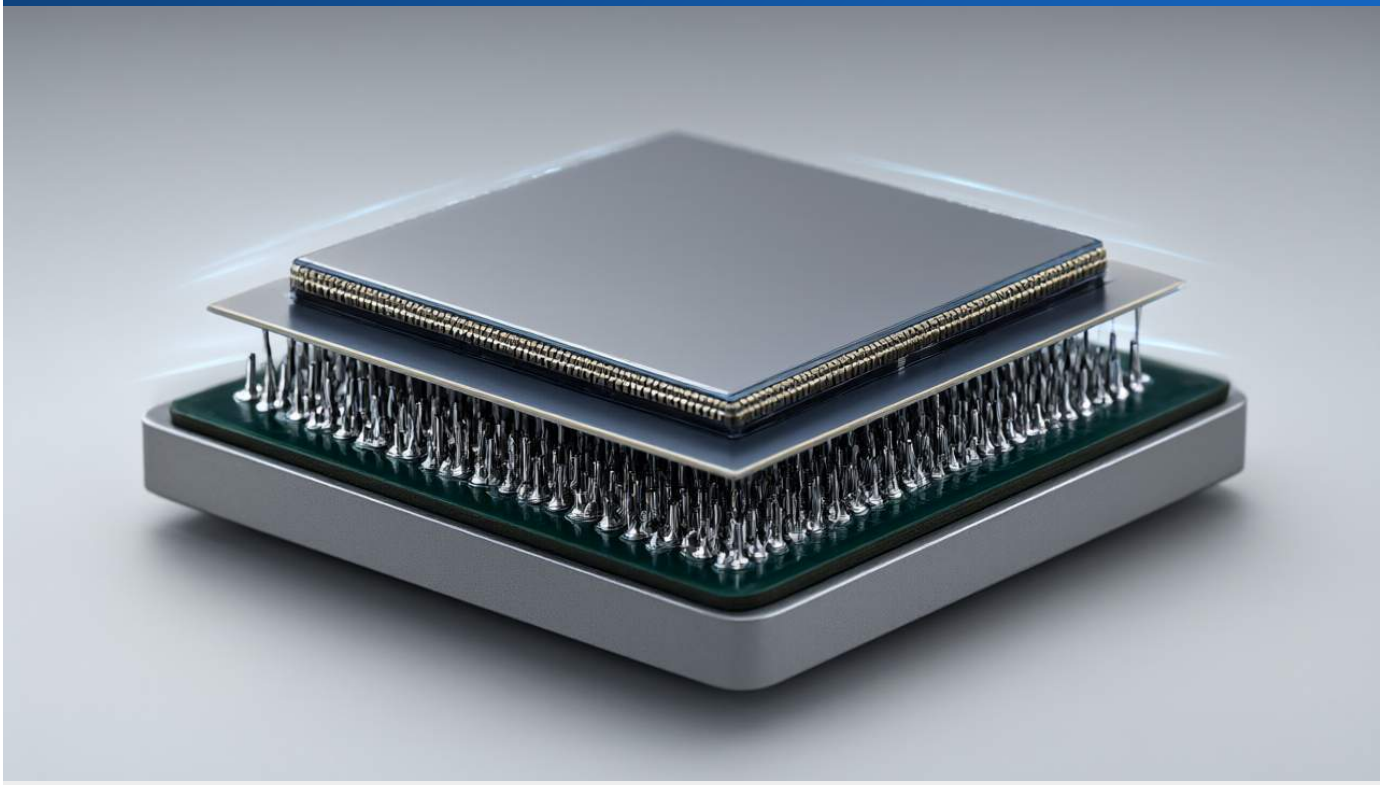
By establishing backbone length as a critical design parameter, this research provides a route to creating tough, molecularly thin interfaces. This capability is particularly relevant for heterogeneous integration, where maintaining mechanical reliability across dissimilar materials at the molecular scale is essential for device robustness.

Source: https://doi.org/10.21203/rs.3.rs-11438059/v1

Collected: November 21, 2026 | Automated Research System (AI)

#03 2.5D Packaging BGA Solder Joints: Random Vibration Optimization

Published November 16, 2026　Research Square（プレプリント）



OVERVIEW

Research into 2.5D packaging has identified an optimal parameter combination—upper BGA height of 0.24 mm, lower BGA height of 0.38 mm, and interposer thickness of 0.1 mm—to minimize solder joint stress. By utilizing finite element modeling and the Taguchi method, the study determines how specific geometric factors influence vibration reliability. These findings provide a framework for reducing cumulative fatigue damage in high-performance packaging structures.

IN DEPTH

Key Findings

The study identifies the optimal geometric configuration to minimize maximum random vibration stresses in 2.5D packaging: an upper BGA solder joint height of 0.24 mm, a lower BGA solder joint height of 0.38 mm, and an interposer thickness of 0.1 mm. The research reveals that different factors dominate stress levels depending on the joint location. For upper BGA solder joints, the influence ranking is upper BGA solder joint height > lower BGA solder joint height > interposer thickness. Conversely, for lower BGA solder joints, the ranking is interposer thickness > lower BGA solder joint height > upper BGA solder joint height.

Technical Details

To achieve these results, the researchers employed a multi-step analytical approach:

- **Modeling and Verification:** A finite element model of the BGA solder joints was established, and a strain measurement platform was constructed to verify the accuracy of the simulations.
- **Experimental Design:** Using the Taguchi method, an orthogonal array of 16 trials was designed to test combinations of upper BGA height, lower BGA height, and interposer thickness.
- **Analysis Methods:** The team performed range analysis and analysis of variance (ANOVA) on the maximum random vibration stresses obtained from the 16 parameter combinations.
- **Optimization:** A grey relational dual-objective optimization method was applied to determine the optimal parameters, which were subsequently verified through further simulation.

Background & Context

2.5D packaging relies on BGA solder joints to maintain electrical and mechanical connectivity. However, these joints are susceptible to random vibration loading, which can lead to cumulative fatigue damage. Understanding the relationship between the physical dimensions of the interposer and the solder joints is critical for maintaining structural integrity under dynamic loads.

Significance & Outlook

By quantifying the impact of interposer thickness and solder joint height, this research provides a precise methodology for improving the vibration reliability of 2.5D packaging. Implementing the identified optimal dimensions helps reduce the risk of mechanical failure, thereby extending the operational lifespan of the packaging structure in environments subject to random vibration.

Source: https://doi.org/10.21203/rs.3.rs-11033973/v1

Collected: November 21, 2026 | Automated Research System (AI)

#04 Black Phosphorus Nanosheets: Flame-Retardant Epoxy Resin Specs

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OVERVIEW

Researchers have developed a multifunctional nano-curing agent combining aminopropyl-imidazole with black phosphorus nanosheets to enhance the fire safety and mechanical properties of epoxy resin. The additive suppresses combustible volatiles and promotes a graphitized char layer, significantly reducing the peak heat release rate.

IN DEPTH

Key Findings

The integration of aminopropyl-imidazole functionalized black phosphorus nanosheets (BP@AI) into epoxy resin significantly improves flame retardancy and mechanical strength. Specifically, the EP/BP@AI-5 formulation demonstrated the lowest peak heat release rate and total heat release during cone calorimetry testing. Additionally, the EP/BP@AI-3 formulation achieved a tensile strength of 60.44 MPa and an elongation at break of 13.73 percent, marking the highest mechanical performance in the study series.

Technical Details

The nano-curing agent was produced via liquid-phase exfoliation of black phosphorus, followed by non-covalent self-assembly with 1-(3-aminopyl)-imidazole, resulting in an AI content of approximately 37 weight percent. Structural characterization confirmed the creation of few-layer black phosphorus nanosheets with effective imidazole group loading. Rheological studies and differential scanning calorimetry indicated that the material maintains good storage stability and a moderate curing temperature, with a curing rate comparable to EP/AI.

The flame-retardant mechanism involves a dual-action approach:

- **Condensed-phase charring:** The BP@AI additive promotes the formation of a continuous and compact graphitized char layer on the material surface.
- **Gas-phase inhibition:** The additive simultaneously suppresses the release of combustible volatiles.

These effects were verified through residue and thermogravimetric-FTIR analyses, which showed a reduced average effective heat of combustion and an increased fire performance index.

Background & Context

This research, published in Polymer Bulletin (Volume 84, Issue 1, Article 36), addresses the need for multifunctional additives in polymer science. By utilizing surface functionalization and nanotechnology, the study explores how interfacial interactions between the nano-curing agent and the epoxy matrix can simultaneously address thermal stability and structural integrity.

Significance & Outlook

The development of a multifunctional nano-curing agent allows for the enhancement of fire safety without compromising the mechanical properties of epoxy resins. The ability to achieve high tensile strength while reducing the intensity of combustion provides a viable pathway for developing safer, high-performance composite materials in chemical engineering.

Source: https://bioengineer.org/functionalized-black-phosphorus-nanosheets-enhance-fire-safety-in-epoxy-resin/

Collected: November 21, 2026 | Automated Research System (AI)

#05 Dai-ichi Kogyo Seiyaku: High-Strength Room-Temperature Urethane Resin Specs

Published November 20, 2026　時事ドットコム（第一工業製薬 PR TIMES）　Japan



OVERVIEW

Dai-ichi Kogyo Seiyaku has developed a two-component, room-temperature curing high-strength urethane resin that significantly improves adhesion to metals like aluminum. The material achieves 3 to 11 times the adhesion performance of conventional products while eliminating the need for heat curing, reducing energy consumption in manufacturing.

IN DEPTH

Key Findings

Dai-ichi Kogyo Seiyaku has developed a two-component room-temperature curing urethane resin that maintains high glass transition temperature (Tg) and physical properties while significantly enhancing adhesion to metals. Specifically, the adhesion performance to aluminum has increased approximately 3 times compared to conventional products, with overall metal adhesion improvements ranging from 3 to 11 times.

Technical Details

The material is a two-component system consisting of polyol and isocyanate liquid components. Unlike epoxy resins, which typically require heat for curing, this urethane resin cures at room temperature. Despite the lack of heat treatment, the resin maintains high Tg, long-term durability, and physical properties comparable to those of epoxy resins.

Background and Context

The development addresses the industry challenge of balancing high physical properties with strong adhesion to metal substrates such as aluminum, copper, and iron. This need is driven by the increasing functional requirements of automotive and home appliance components. Additionally, the shift toward decarbonization has created a demand for manufacturing processes that reduce CO2 emissions by eliminating energy-intensive heating stages.

Significance and Outlook

By removing the requirement for heating during the curing process, the resin enables a reduction in energy consumption and allows for the simplification of manufacturing equipment. The company intends to evaluate the material for several specific applications, including:

- Battery peripheral components in the automotive and home appliance sectors.
- Sealing and fixing of electronic components.
- Adhesion for metal housings.

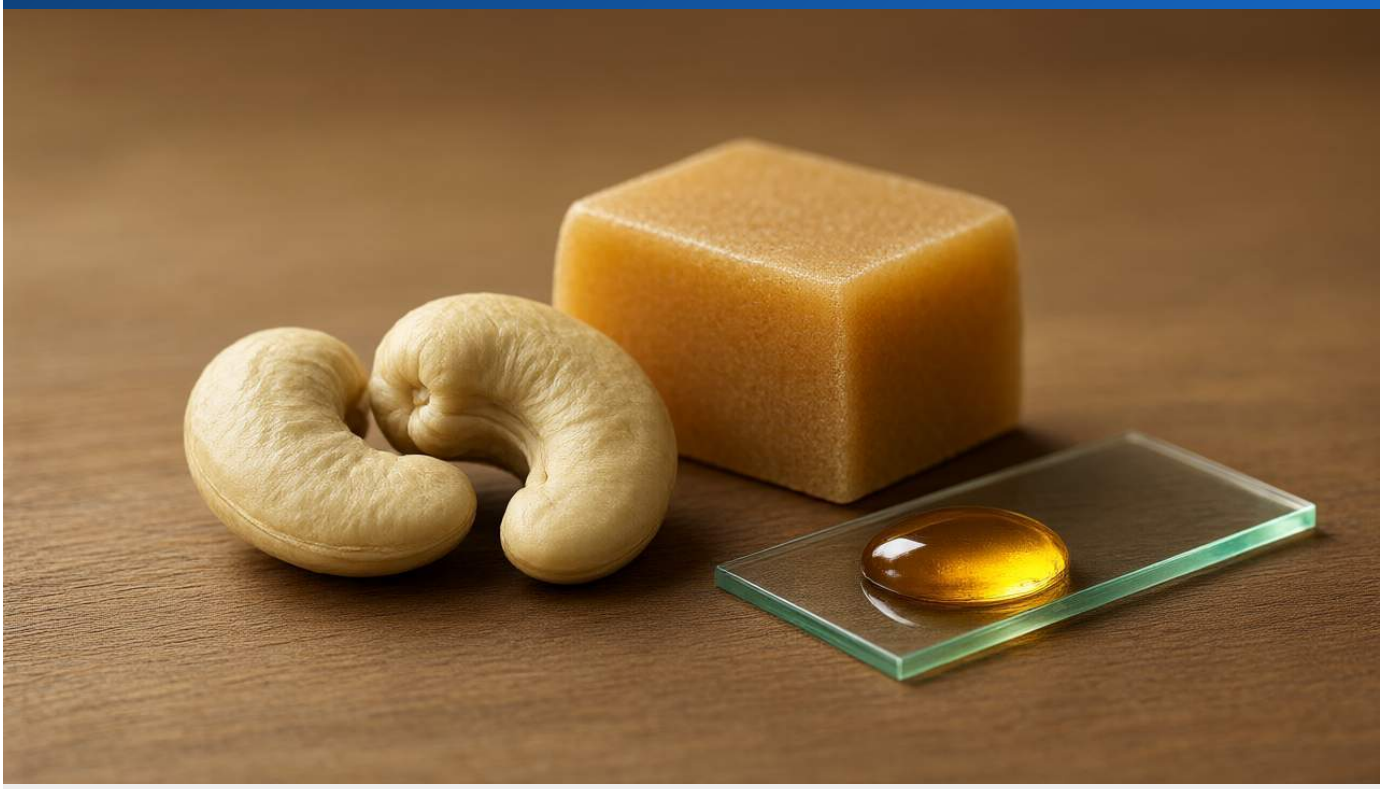
The development aims to contribute to sustainable society goals by reducing environmental loads and improving production efficiency for manufacturers.

Source: https://www.jiji.com/jc/article?k=000000229.000073630&g=prt

Collected: November 21, 2026 | Automated Research System (AI)

#06 Cashew Nut Shell Polyurethane: Bio-based Adhesive and Foam Specs

Published November 20, 2026 산업인뉴스 South Korea



OVERVIEW

A research team from Inha University developed a biodegradable and reprocessable polyurethane adhesive and foam using cardanol extracted from cashew nut shells. The materials achieve a bio-carbon content of 71% and demonstrate rapid degradation under alkaline conditions, offering a sustainable alternative to petroleum-based polymers.

IN DEPTH

Key Findings

The SPL team from Inha University, led by Heo Seo-jung and supervised by Professor Kim Hee-jung, developed eco-friendly polyurethane pressure-sensitive adhesives (PSA) and foams derived from cashew nut shell liquid. This research earned the Minister of Trade, Industry and Energy award at the "2026 Industry-Academic Project Challenge" held on November 19 at SETEC in Seoul.

Technical Details

The team utilized cardanol, a bio-raw material extracted from discarded cashew nut shells, to replace petroleum-based precursors. The resulting materials exhibit the following technical specifications:

- **Pressure-Sensitive Adhesive:** Achieved a bio-carbon content of 71% and a peel adhesion of 3.2N/cm without additional tackifying agents. Under alkaline conditions at room temperature, the polymer molecular weight decreased by more than 85% within three days.
- **Polyurethane Foam:** Demonstrated a compressive strength of approximately 270kPa. The foam is reprocessable via heat and pressure, with successful reprocessing completed in approximately 45 minutes after degradation.

Background and Context

The project was conducted under the "White Bio Industry Professional Manpower Training Project," supported by the Ministry of Trade, Industry and Energy and Incheon Metropolitan City. The Korea Polymer Materials Research Association served as the managing organization. Technical support and bio-raw materials were provided by Femizolio Co., Ltd. The "2026 Industry-Academic Project Challenge" was held in conjunction with "Youth NEW:TURN 2026," involving 1,519 graduate students across 596 teams.

Significance and Outlook

The research has been recognized as a cover story in the international journal *Green Chemistry*. The team has filed two patents, including a joint patent with Hyundai Motor Company regarding eco-friendly adhesive materials, and produced two prototypes. Currently, technology transfer for the polyurethane foam is under discussion. The technology is expected to expand into various industrial applications, including packaging materials, adhesives, and insulation.

Source: https://www.sanupin-news.kr/news/articleView.html?idxno=16157

Collected: November 21, 2026 | Automated Research System (AI)

#07 Euglena-derived Binder: PVDF Alternative for Li-ion Batteries

Published November 18, 2026 EE Times Japan Japan



OVERVIEW

The National Institute of Advanced Industrial Science and Technology (AIST) has developed a biomass-based cathode binder derived from Euglena. The material achieves a capacity retention rate of over 97% after 100 cycles, matching the performance of conventional fluorine-based polymers.

IN DEPTH

Key Findings

A research team at the National Institute of Advanced Industrial Science and Technology (AIST) has developed a cathode binder for lithium-ion batteries using materials derived from Euglena. In comparative tests against the industry-standard polyvinylidene fluoride (PVDF), the Euglena-derived binder demonstrated nearly identical charge-discharge cycle characteristics, with both materials maintaining a discharge capacity retention rate of 97% or higher after 100 cycles.

Technical Details

The researchers focused on paramylon, a substance derived from Euglena, as the raw material. By esterifying the hydroxyl groups of paramylon with fatty acids, they created "paramylon esters." The team found that adjusting the type and quantity of fatty acids allowed them to modify material properties such as flexibility and thermoplasticity.

Among the various synthesized versions, "paramylon octanoate"—created by bonding octanoic acid—was identified as the optimal binder for the cathode. The production process mirrored existing PVDF workflows: a slurry consisting of the binder, cobalt acid lithium (active material), and acetylene black (conductive agent) was mixed in the organic solvent N-methyl-2-pyrrolidone (NMP), coated onto aluminum foil, and dried to form the electrode layer. These electrodes were then integrated into pouch-type evaluation batteries with graphite anodes and separators.

Background and Context

PVDF is currently the dominant binder used to fix electrode materials to metal foils in lithium-ion batteries due to its stability. While research into biomass alternatives has progressed, previous candidates often struggled with adhesive strength, electrochemical stability, or compatibility with existing manufacturing processes.

Significance and Outlook

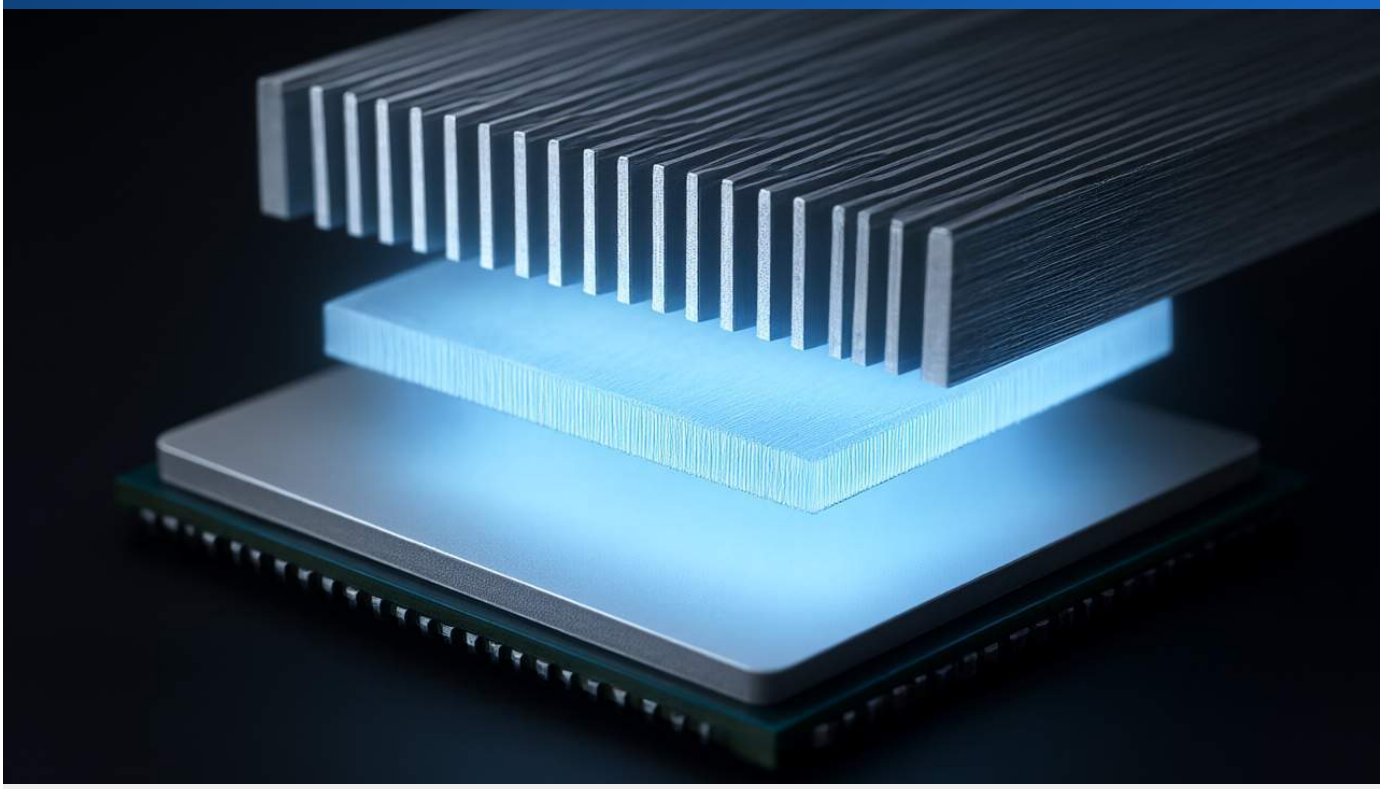
The development proves that a biomass-derived material can match the performance of fluorine-based high-polymer materials in a standard battery configuration. AIST intends to further verify the material's long-term durability, safety, production costs, mass-production feasibility, and overall compatibility with industrial battery manufacturing processes.

Source: https://eetimes.itmedia.co.jp/ee/articles/2611/18/news037.html

Collected: November 21, 2026 | Automated Research System (AI)

#08 Polymer Fiber Forest: Cornell's Thermal Interface Material Specs

Published November 18, 2026 Cornell Chronicle USA



OVERVIEW

Researchers at Cornell have developed a "polymer fiber forest" architecture that enhances heat dissipation in electronics without conducting electricity. The epoxy-based version reduced surface temperatures by 17 degrees Celsius compared to commercial ceramic-filled silicone pads.

IN DEPTH

Key Findings

The epoxy-based polymer fiber forest achieved a 25% reduction in temperature compared to a commercially available ceramic-filled silicone thermal pad, keeping the heated surface 17 degrees Celsius cooler at a heating power of approximately 1.2 watts. The material architecture enables efficient heat transfer from electronic components to cooling systems while maintaining electrical insulation to prevent short circuits.

Technical Details

The architecture consists of thousands of microscopic Zylon polymer fibers arranged vertically. Zylon was selected for its high thermal conductivity along its length. The manufacturing process involves packing Zylon fiber bundles into a mold, building the structure horizontally layer by layer, and filling the gaps with a polymer material. Once hardened, the material is rotated 90 degrees to ensure the fibers stand vertically.

The team tested two different surrounding materials to adjust mechanical properties:

- **Epoxy-based:** Achieved a thermal conductivity of 16.8 watts per meter-kelvin.
- **PDMS (silicone-like polymer):** Achieved a thermal conductivity of 12.0 watts per meter-kelvin and offered a softer mechanical profile.

Background & Context

Thermal interface materials must fill gaps between computer chips, heat spreaders, and heat sinks. Traditionally, materials that conduct heat efficiently also conduct electricity, while insulating polymers typically conduct heat poorly. While aligning molecular chains in polymers can improve heat transfer, translating this property into a scalable format for electronics has been a challenge. A 2025 study by Zhiting Tian's group used stretched bulk polymer bars, but their square millimeter cross-sectional areas limited the heat transfer area.

Significance & Outlook

The "forest" design allows for the multiplication of fibers to increase the heat transfer area and can be manufactured in various dimensions to fit specific devices. Because the architecture is tunable, engineers can potentially integrate other heat-conducting fibers and surrounding materials to customize properties for different industrial applications.

Source: https://news.cornell.edu/stories/2026/11/microscopic-polymer-fiber-forest-helps-keep-electronics-cool

Collected: November 21, 2026 | Automated Research System (AI)

#09 PV Module Recycling: Induction Heating for 99.8% Mass Recovery

Published November 16, 2026 pv magazine Australia Australia



OVERVIEW

An international research team has developed an induction heating-assisted delamination method for glass-to-glass PV modules that recovers 99.8% of the original mass. The process enables rapid separation of silicon cells from encapsulants in as little as 5.4 seconds, significantly improving the recyclability of end-of-life modules.

IN DEPTH

Key Findings

Researchers from the University of New South Wales (UNSW) and the Korea Electronics Technology Institute (KETI) have achieved a near-complete recovery of PV module components. Using a modified glass-to-glass design and induction heating, the team recovered 99.8% of the total module mass, including the glass, silicon cells, and polymer encapsulant. In the fastest recorded test, module layers separated in 5.4 seconds.

Technical Details

The process utilizes a water-cooled copper induction coil operating between 270 kHz and 300 kHz to rapidly heat the metal contacts of passivated emitter and rear contact (PERC) cells. This creates a temperature difference of over 200 C between the cell and the glass at a coil current of 100 A, triggering localized decomposition of the ethylene vinyl acetate (EVA) encapsulant at the cell interface.

The researchers employed specific design modifications to facilitate this separation:

- **Simulation:** Comsol Multiphysics was used to analyze the effects of operating frequency, coil current, coil-to-cell distance, and electrode thickness.
- **Module Design:** Mini-modules (5 cm × 8 cm, 1 mm thick glass) incorporated Polytetrafluoroethylene (PTFE) release films with 1.8 cm × 1.8 cm central openings to allow gases to escape during heating.
- **Separation Method:** Modules were suspended in a custom jig facing downward to utilize gravity-assisted separation.

Separation times varied by coil current: 18.6 seconds at 100 A, 8.3 seconds at 150 A, and 5.4 seconds at 200 A. Post-delamination, EVA was mechanically scraped from the glass with less than 10% mass loss.

Significance and Outlook

Microscopy and spectroscopy confirmed that recovered cells showed no significant structural damage or polymer residue, and the remaining EVA largely retained its chemical structure. The team intends to scale this process from mini-modules to full-size commercial PV panels for use in industrial recycling operations.

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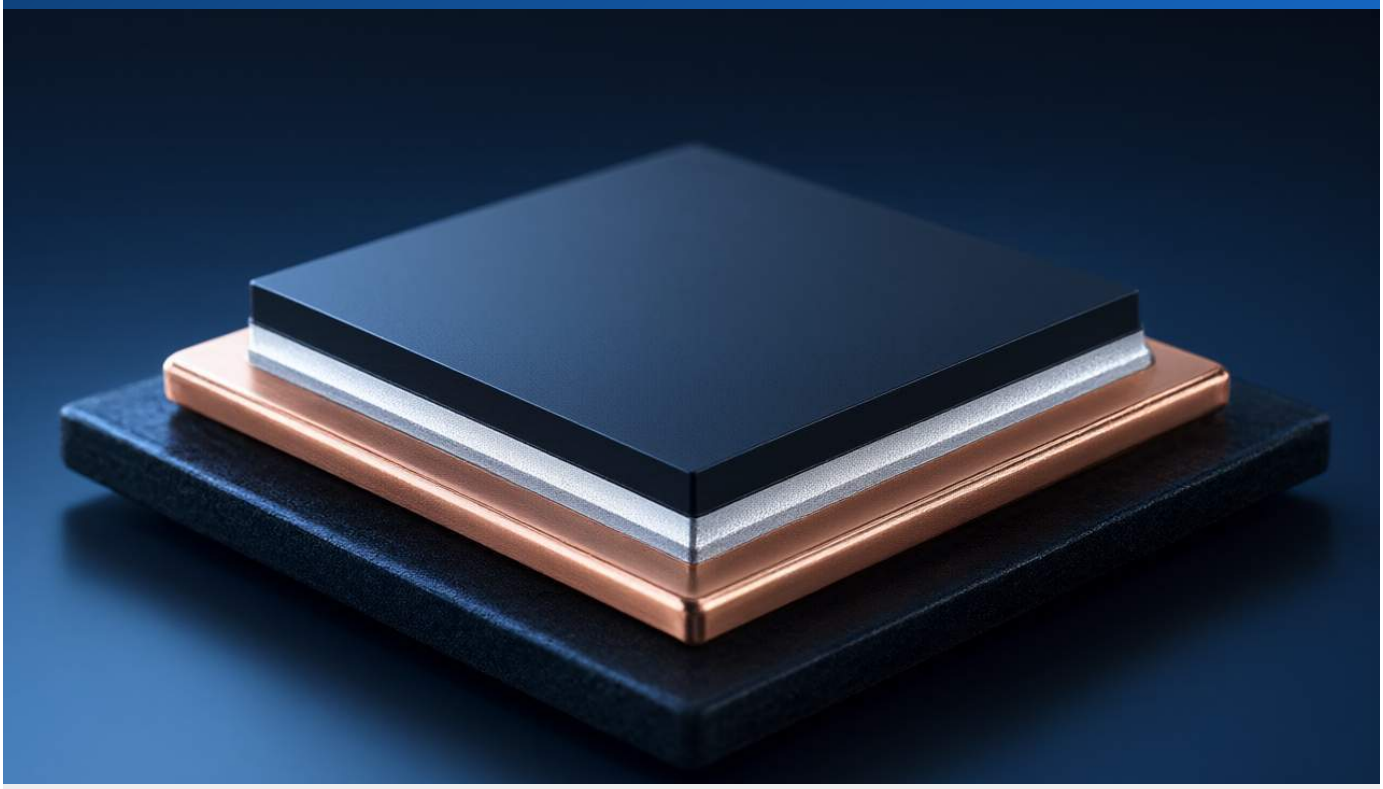
Source: https://www.pv-magazine-australia.com/2026/11/16/new-glass-to-glass-pv-module-design-enables-rapid-delamination/

Collected: November 21, 2026 | Automated Research System (AI)

#10 Cu/In-Ag/Cu Bonding: Microwave Heating and Nano-Silver Specs

Published November 17, 2026 BIOENGINEER



OVERVIEW

Researchers have developed a bonding technique for semiconductor power devices using microwave hybrid heating (MHH) and nano-silver reinforcement to create high-temperature-stable die-attach interconnects. The optimized configuration achieved a shear strength of 28.05 MPa, a more than four-fold increase over silver-free joints. This method significantly reduces processing times and enhances reliability for third-generation semiconductor power technologies.

IN DEPTH

Key Findings

The integration of microwave hybrid heating (MHH) and nano-silver (Ag) reinforcement in Cu/In-Ag/Cu joints resulted in a peak shear strength of 28.05 MPa. This represents a substantial improvement compared to the 6.02 MPa observed in joints without silver. The study identified 30 weight percent nano-Ag as the optimal concentration; increasing the silver content to 40 weight percent reduced shear strength to approximately 11.3 MPa due to coalescing porosity.

Technical Details

To accelerate reaction kinetics and overcome the prolonged isothermal holding times of conventional solid-liquid interdiffusion (SLID) processes, the team utilized a bulk silicon carbide (SiC) susceptor. This setup allows molten indium to absorb microwave energy directly, creating a volumetric heating effect that promotes rapid intermetallic compound (IMC) growth. Key technical observations include:

- **Diffusion Mechanisms:** The growth of Cu11In9 shifted from bulk-diffusion to grain-boundary-diffusion as temperatures increased from 170 °C to 250 °C.
- **Joint Quality:** Processing at 250 °C for 120 minutes with 30 weight percent nano-Ag produced dense full-IMC joints free of large voids and residual indium.
- **Stability:** The formation of the (Ag, Cu)In2 phase suppressed copper transport, enhancing microstructural stability against electromigration.

Background and Context

Conventional SLID bonding often requires extensive time to convert solder into stable IMCs, limiting its efficiency for high-temperature packaging. This research specifically targets the reliability of third-generation semiconductor power devices, which operate under demanding thermal conditions.

Significance and Outlook

Long-term reliability tests conducted at a constant temperature of 280 °C over 675 hours showed that while shear strength gradually decreased to 4.17 MPa, the Ag-containing IMCs delayed void growth and structural degradation. By improving joint uniformity and mechanical performance, this MHH and nano-Ag strategy provides a viable pathway for extending the lifespan of high-temperature power electronics packaging.

Source: https://bioengineer.org/microwave-heating-and-nano-silver-boost-high-temperature-semiconductor-power-device-bonding/

Collected: November 21, 2026 | Automated Research System (AI)

#11 Composite Epoxy Coating: Delaying LIB Thermal Runaway by 465s

Published November 19, 2026 European Coatings



OVERVIEW

Researchers have developed a composite flame-retardant epoxy coating that delays the onset of lithium-ion battery thermal runaway by 465 s and reduces adjacent cell peak temperatures by 272 °C. The material achieves UL-94 V-0 classification and cuts total smoke production by up to 76.4%, significantly enhancing safety for electromobility and energy storage.

IN DEPTH

Key Findings

The developed composite coating, specifically the EP/20RMH@AP-Fe1/PEPA4 formulation, significantly improves the thermal safety of lithium-ion batteries (LIBs). In thermal runaway propagation tests, the coating delayed the onset of thermal runaway at the directly heated Position-1 battery by 465 s. Furthermore, it reduced the peak temperature of the adjacent Position-2 battery by 272 °C compared to uncoated cells.

Technical Details

The coating is a composite intumescent flame-retardant system combining two complementary agents: a biomass-based supramolecular magnesium hydroxide rod-crystal (RMH@AP-Fe) and a cage-like small-molecular charring agent called pentaerythritol phosphate (PEPA). While RMH@AP-Fe provides interfacial compatibility with the epoxy (EP) matrix, the addition of PEPA enhances char quality to create a continuous protective barrier during combustion.

- **Fire Safety Standards:** The optimized formulation achieved UL-94 V-0 classification.
- **Oxygen Index:** The limiting oxygen index (LOI) reached 28.0%.
- **Smoke Suppression:** Compared to pure EP, the peak smoke production rate decreased by 48.1% and total smoke production decreased by 76.4%.

Background and Context

Epoxy resin is widely used in new energy vehicle components, such as insulating parts and battery protection housings, due to its adhesion, electrical insulation, and mechanical strength. However, the carbon- and hydrogen-rich structure of standard epoxy leads to rapid flame spread and the release of dense, toxic smoke during combustion, creating a critical safety challenge for battery packs.

Significance and Outlook

The reduction in smoke and toxic gas release is particularly critical for battery fire scenarios, as it extends evacuation time and minimizes secondary hazards. Ablation tests and backside temperature measurements confirmed the material's effectiveness in thermal insulation and ablation resistance. The researchers suggest this multifunctional organic coating provides an innovative strategy for improving the safety of emerging applications in energy storage and electromobility.

Source: https://www.european-coatings.com/news/coatings-technologies/fire-safe-coating-delays-lithium-ion-battery-thermal-runaway/

Collected: November 21, 2026 | Automated Research System (AI)

#12 ECHA PFAS and Chromium(VI) Restrictions: 2026 Regulatory Timeline

Published November 20, 2026 European Coatings Europe



OVERVIEW

The European Chemicals Agency's Committee for Socio-Economic Analysis (SEAC) has adopted final opinions supporting EU-wide restrictions on PFAS and certain chromium(VI) substances. These opinions move the proposals to the European Commission for final regulatory steps, signaling a shift toward stricter control of persistent and carcinogenic chemicals.

IN DEPTH

Key Findings

On November 19, 2026, the European Chemicals Agency (ECHA) announced that its Committee for Socio-Economic Analysis (SEAC) adopted final opinions supporting restrictions on polyfluoroalkyl substances (PFAS) and specific chromium(VI) oxides, oxyacids, and salts. These opinions conclude the scientific evaluation phase, and the proposals will now be forwarded to the European Commission for discussion and voting within the REACH Committee.

Technical Details

Regarding PFAS, SEAC supports a ban featuring use-specific derogations. The committee recommends transition periods to facilitate the development of alternatives and suggests time-limited derogations for certain sectors. While SEAC supports additional risk management measures to minimize emissions from derogated uses—as recommended by the Committee for Risk Assessment (RAC)—it noted that current information is insufficient to fully assess the costs and benefits of these specific measures.

For chromium(VI) substances, SEAC favors "restriction option number two," which it identifies as the best balance between reducing human exposure to carcinogens and managing socio-economic impacts. SEAC recommends a transitional period of at least 36 months and calls for the creation of implementation and enforcement guidelines.

Background and Context

PFAS and their degradation products are characterized as highly persistent substances capable of contaminating soil and groundwater. Both RAC and SEAC determined that existing regulatory measures are insufficient to control these risks. The PFAS proposal was originally submitted in January 2023 by the national authorities of Germany, Denmark, Norway, Sweden, and the Netherlands.

The chromium(VI) substances involved are known carcinogens; most are already designated as Substances of Very High Concern (SVHCs) and listed under REACH Authorization, with the exception of barium chromate. This restriction follows a 2023 request from the European Commission to ECHA.

Significance and Outlook

The final SEAC and RAC opinions, along with background documents, will be published on ECHA's website. The European Commission will use these findings to propose formal restrictions, which will then be subject to a vote by EU member states in the REACH Committee.

Source: https://www.european-coatings.com/news/legislation/echa-backs-eu-wide-restrictions-on-pfas-and-chromium-vi/

Collected: November 21, 2026 | Automated Research System (AI)